



Consortium of Universities for the Advancement of Hydrologic Science, Inc.

C UAHSI ANNUAL REPORT

2012

CUAHSI enables the university water science community to advance understanding of the central role of water to life, Earth, and society. CUAHSI focuses on water from bedrock to atmosphere, from summit to sea and from the geologic past, through the present and into the future.

CUAHSI Office Locations

Consortium of Universities for the
Advancement of Hydrologic Science, Inc.
2000 Florida Ave, NW
Washington, D.C. 20009, USA
Tel: 202.777.7306

Consortium of Universities for the
Advancement of Hydrologic Science, Inc.
196 Boston Ave, Suite 3800
Medford, MA 02155, USA
Tel: 339.221.5400



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Letter from the President

CUAHSI and You

Dear Colleagues,

I often hear from community members that CUAHSI should do [fill in the blank, "review text books", "provide graduate short courses", "get free instrumentation for field studies", etc.] I'd like to use this letter to describe how you can engage with CUAHSI to suggest new ideas, to influence our current activities, and to comment on (and to improve) the services we offer now.

CUAHSI is a mechanism for designing and delivering services and infrastructure for the community, but YOU are a critical part of that mechanism. New ideas for services are welcome and officially solicited at the beginning of each calendar year when we request brief "prospectuses" from the community. (Watch for the announcement in January.) These prospectuses are reviewed by the appropriate Standing Committee in the spring and advanced to the Board of Directors for the July meeting when priorities for the coming year are decided.

What makes an effective prospectus? Mostly your willingness to make them a reality! The CUAHSI staff can work with you to develop a strategy and help support an activity once it is approved by the Board. If the activity is mostly organizing the community to achieve something (say, a survey of introductory hydrology textbooks and a system for rating them), then such ideas can advance without additional financial resources. But you must be willing to work with the staff to develop the surveys, help analyze the results and help to define what an effective product looks like. If the activity requires new financial resources (say, a center for moving instrumentation from the desktop to the field), then a far more detailed strategy, involving workshops, proposals for pilot activities, and demonstration projects is needed.

Whether simple or complex, new activities need your continued involvement to make them a reality. You have a far more detailed knowledge of what is needed and what might work, than the CUAHSI staff has. Furthermore, our small staff is already fully committed to existing activities. Just like you, we will go the extra mile to make something happen, but we can't do it on our own. YOU are CUAHSI and are critical to making any of our activities successful.

If you have an idea for what CUAHSI should do, please feel free to contact any of our staff to discuss how we might make it a reality. We want to maximize our value to the community and we need to hear from you to do that. Successfully advancing any new initiative, however, will require your involvement, too. We want to make sure your time donated to the community is rewarding. Look at this effort as community service just as much as reviewing manuscripts or serving as an editor at a journal.

What are other ways to get involved with CUAHSI? Serve on a Standing Committee. There are a number of them and all have openings. If you are interested in Education and Outreach, Instrumentation, Informatics (including the CUAHSI Data Center and HIS), Observations, or Synthesis, there is a committee for you! The time commitment is modest and you get involved with understanding how CUAHSI works.

Consider running for the Board of Directors. This is a more substantial time commitment but with commensurate recognition.

We look forward to an exciting year with the establishment of the first CUAHSI-operated facility and continued engagement with NSF in the EarthCube initiative. Funding from the Johnson Family Foundation and gifts from philanthropists will enable six *Let's Talk about Water* events to be held around the country. Despite funding uncertainties surrounding the federal budget, we are moving forward on multiple fronts with services to our community.

The Officers, Directors and Staff of CUAHSI welcome your continued engagement in the Consortium's activities and look forward to serving you in 2013.

Warm regards,



Rick Hooper,
President

OVERVIEW AND ACCOMPLISHMENTS

CUAHSI exists to enable the water science community to advance a community approach for basic and applied research in water science. Our research and education activities are aligned around a set of objectives contained in our 2010 Strategic Plan and are meant to support and enhance the broad portfolio of water research being carried out by the university water research community. This year, major activities and accomplishments included:

- Assuming management responsibility of the **CUAHSI Hydrologic Information System**, managing a metadata catalog that now contains **over 95 public water data sources** from government agencies, university sources, and other data providers, a server software stack and the HydroDesktop client software for data access, download and analysis. **Over 7.5 million time series were downloaded through HIS in 2012.**
- **Adoption of WaterML 2.0 as a standard by the Open Geospatial Consortium, and an approval by the UN Commission on Hydrology of the World Meteorological Organization of a process to consider it as a global standard.** We continue to see that HIS is of great interest to the informatics community to see how a scientific community adopts new informatics tools and how water data can be made interoperable with data from allied fields such as atmospheric sciences. **The HIS project has laid the foundation for our community to participate in cyberinfrastructure development, such as the EarthCube initiative, and for our scientists to benefit from these investments.**
- **Holding our third Biennial meeting, Fusing Science and Solutions**, delivering a high-quality science program to a diverse group of 161 water research students, faculty and professionals, an all time high.
- Supporting instrumentation services that included a **Hands-On Training on Techniques for Stream-Groundwater Exchange** in conjunction with Penn State University that **trained 25 students and faculty**, holding a **technical exchange workshop collaboratively with the USGS** that brought together **61** agency scientists, academics and instrument manufacturers to examine the potential of hydroacoustic technology for sediment transport measurement and monitoring, and **facilitating increased use of geophysical techniques in hydrology** by funding five collaboration grants through the HydroGeoPhysics (HGP) program.
- Expansion and increased visibility of Education and Outreach activities. Applications to the Pathfinder fellowship program for multi-site research, which in 2011 **funded five Fellowships** to support graduate student research travel, and interest in the **Let's Talk About Water program** (as measured by the number of events and inquiries) have increased. **Cyberseminars** continue to be a valuable resource to the community, with steady participation in live seminars, and continued access of archived seminars.

How Can I Get More Involved?

Join a **Standing Committee** and voice input on the direction of CUAHSI program development.

As an official member representative, you are eligible to run for CUAHSI's **Board of Directors** and directly impact activity priorities.

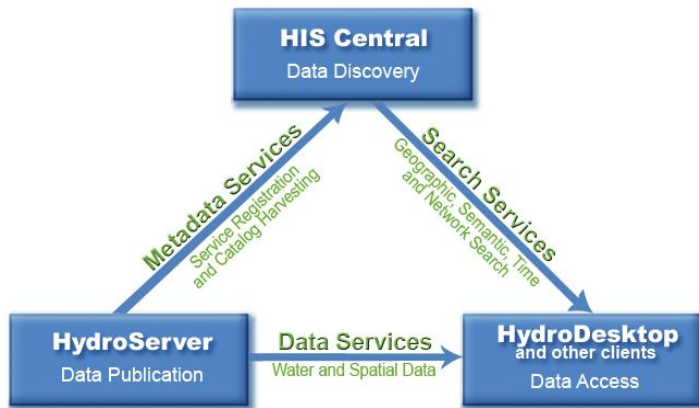
Submit workshop proposal ideas to CUAHSI for further development and potential support.

CUAHSI is always soliciting information from our community to highlight in the monthly online newsletter including research projects, field photos, and other opportunities.

II. CUAHSI HYDROLOGIC INFORMATION SYSTEMS

The **CUAHSI Hydrologic Information System (CUAHSI – HIS)** is an internet –based system for sharing water data. CUAHSI has pioneered centralized, community access to water data resources based upon a service oriented architecture developed in the HIS project over several years by a number of university partners led by David Maidment at UT-Austin. 2012 saw the transition of the system from a prototype research project to an operational system managed centrally by CUAHSI.

The System



2012 HIS Highlights

- » **Over 7,500,000 time series** downloaded in 2012
- » **23 new data sources** accessible through the system
- » **New and Continuing Partnerships with USGS, EPA, NASA,** and other federal agencies making time series of water-relevant data holdings readily accessible
- » **Release of HydroDesktop 1.5**, new version of our free, GIS-based data discovery and access software.
- » **Adoption of WaterML** transmission language by the Open Geospatial Consortium, supporting standard and expanding access to water data worldwide.

CUAHSI-HIS consists of three components. This year, CUAHSI assumed control of the maintenance and management of the components. In July, CUAHSI submitted a **5 year, \$5 million** proposal to operate a **Water Data Center**, to maintain HIS for the long term, and to provide data publishing and archiving support to the University community.

HIS Central catalogs metadata and facilitates search and discovery of water data from over 95 registered sources. CUAHSI works with federal agencies such as USGS and EPA to provide centralized access to their data holdings through CUAHSI HIS, as well as supporting University researchers, state and local agencies, and other organizations that want to share their data.

HydroServer provides an open source solution to projects who want to run their own server and manage their data. In 2012, a new version of HydroServer that uses a new expanded version of **ODM 1.1**, a relational database designed for hydrologic data, was released. **HydroPortal** is a HydroServer maintained by the CUAHSI office that will store and publish data for projects that do not want to maintain a service.

INFORMATICS STANDING committee

D. Scott MACKAY (Chair)	SUNY at Buffalo
Carol JOHNSTON (Board Liaison)	SD State University
Kathy BOWER	E Illinois University
Ibrahim DEMIR	University of Iowa
Ben DOMENICO	Unidata
Marilyn KAMINSKI	NSIDC
Scott PECKHAM	CSDMS, UC-Boulder
Christina TAGUE	UC - Santa Barbara
Mark WILLIAMS	University of Colorado
Peter WILLIAMS	IBM
Kathleen MCKEE – HIS Users Committee Chair	

AGENCY reps

Tod DABOLDT	EPA	Deborah HAYES	USFS
Katherine LINS	USGS	Russ VOSE	NCDC
Mark WALBRIDGE	ARS		

New versions of data access clients that work with the HIS system, **HydroDesktop and HydroExcel**, were released in 2012. There have been over 3500 downloads of HydroDesktop 1.4 since its release in March. HydroDesktop 1.5, which was developed with extensive input by the new HIS User Committee, is scheduled for release in December 2012.

2012 Activities and Projects

CUAHSI and our University partners are continually working to expand the capabilities of the HIS components, identify new datasets and improvements to the system, and work toward promoting standards and accessibility for water data worldwide. Specific advancements and projects in 2012 include:

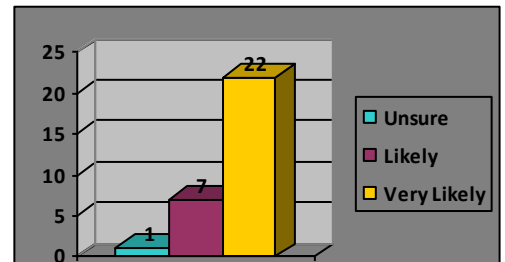
- **Shalenet.org** is an NSF-funded Research Coordination Network (PI: Sue Brantley, Penn State) that is using HIS and assembling a database of pertinent water and environmental data in the Marcellus Shale Region.
- **WaterML 2.0**, a transmission language for time series developed by the HIS project, was adopted by the international standards setting body, the OGC. This paves the way for more interoperability amongst data systems.
- **Over 100 participants** have learned HIS in CUAHSI-led trainings at conferences, meetings and workshops.

III. INSTRUMENTATION TRAINING AND ACCESS

CUAHSI’s Instrumentation programs support advancing the use of instrumentation by the water science community through Training, Access and Development. CUAHSI organizes trainings on cutting edge instrumentation and measurement techniques in conjunction with university researchers, works with instrument providers such as **The Center for Transformative Environmental Monitoring Programs (CTEMPS)** to ensure community access and awareness, and collaborates with the **US Geological Survey** through a Cooperative Research and Development Agreement (CRADA) to support instrumentation development, access to USGS services for our member universities, and other collaboration opportunities.

Training

Our **“Hands-On Workshop”** program provides funding and organization to university researchers who want to share their expertise on instrumentation through trainings and workshops. These workshops are designed and taught by experts from the water science community; CUAHSI provides organization, logistical support, advertising and dissemination, so that instructors can focus solely on sharing their expertise. Topics are drawn from the community through workshop proposals and community surveys. In June 2012, over 25 students, faculty, and professionals participated in a workshop on **Techniques to Quantify Stream-Groundwater Exchange and Shallow Transport** held at Penn State University, with instructors and invited speakers from six universities and the USGS. Our next workshop in February 2013 will focus on **Optical Water Quality Sensors for Nutrients: Concepts, Deployment, and Analysis**, and is being led by faculty at the University of Florida and scientists from the USGS. CUAHSI seeks new ideas and instructors for workshops at any time.



Post-workshop survey question from June 2012 workshop: Are you likely to use some of the techniques, instruments, or ideas learned about at this workshop in the next two years?

Access

CUAHSI continues to support pilot programs and collaboration that increase community access and use of advanced instrumentation. These programs are executed under the concept of the **Virtual Hydrologic Measurement Facility (HMF)** - a series of distributed “nodes” or programs that provide community access to cutting-edge techniques in water science. This concept allows CUAHSI the flexibility to work with instrumentation providers and experts to develop suitable relationships and explore how best to deliver instrumentation expertise or services.

- CUAHSI works with the **Center for Transformative Environmental Monitoring Programs (CTEMPS)** to promote community awareness and use of the center’s instrumentation. CUAHSI’s Instrumentation Standing Committee serves on the external advisory board for CTEMPS, and CTEMPS trainings were held at this year’s CUAHSI Biennial. CTEMPS provides short and intermediate term project access to five field-deployable Distributed Temperature Sensing (DTS) systems.
- Since being piloted in 2010, the **HydroGeoPhysics (HGP) facility** has provided or committed \$21,578 in travel funds to eight total projects with the idea to connect hydrologists with geophysicists and to encourage them to write a joint proposal to test the applicability of new geophysical methods to hydrologic investigations.

“I am seeing more and more how ERI can be used in all sorts of projects, and it is likely that little of this would have happened without the travel grant directing my attention to these technologies and opening my eyes to the possibilities.”

~ Testimonial from HydroGeoPhysics grant awardee

→ As part of our CRADA, CUAHSI members have access to services through the **USGS Hydrologic Instrumentation Facility (HIF) and access to USGS's Standard Reference Sample Service for laboratories.**

INSTRUMENTATION STANDING committee

Klaus NEUMANN (Chair)	Ball State University
Denice WARDROP (Board Liaison)	
Erich HESTER	Pennsylvania State University
Jasmeet JUDGE	Virginia Tech
Todd SCANLON	University of Florida
Bob POREDA	University of Virginia
	University of Rochester

Development

Scientists and engineers are constantly pushing the boundaries of sensors and instrumentation, and finding new and innovative ways to deploy or use cutting edge technologies. For these advances to progress to field-ready and widespread use, university and agencies scientists must be able to share experiences, best practices, and work with instrument manufacturers and engineers that can translate needs and advances into more robust commercial instruments. This is the rationale behind the **Joint CUAHSI-USGS program of technical exchange workshops**. These workshop bring together agency and academic scientists who are using cutting edge technologies, and invite participation from instrument manufacturers, for three intensive days of sharing applications and experiences through invited presentations, discussing needs, limitations and promise of the technologies through small breakout sessions, and informal opportunities to interact and collaborate through poster sessions, panel discussions, and social events.



In March 2012, the 2nd of these workshops, **Sediment Hydroacoustics Techniques for Rivers and Streams**, was held in Shepherdstown, WV, and brought together 60 participants interested in hydroacoustic technology applications for measuring and monitoring suspended load, bed load, bed material and related hydrodynamic characteristics in rivers and streams. The 1st of these workshops was in 2011, on *In-situ* Optical Water Quality Sensor Networks, and was summarized in a USGS Open File Report (<http://pubs.usgs.gov/of/2012/1044>) published earlier this year. Planning for the 2013 Technical Exchange workshop has begun – CUAHSI and USGS are planning an

August 2013 workshop that will explore the use of Laser Spectrometers for water (and other) isotopes and assess the potential for field deployment of these instruments.

IV. EDUCATION AND OUTREACH

CUAHSI continues to develop education and outreach programs that serve the diverse needs of the water science community, with programs that introduce water science concepts to undergraduate and general science audiences, student services that support graduate students in water science, and dissemination of online resources.

EDUCATION & OUTREACH STANDING committee

Benjamin RUDELLE (Chair)	Arizona State University – Polytechnic
David FREYBERG (Board Liaison)	Stanford University
Tony BERTHELOTE	Salish Kootenai Tribal College
Diana DALBOTTEN	University of Minnesota/NCED
Mark GREEN	Plymouth State University
Beverly WEMPLE	University of Vermont

Let's Talk About Water

CUAHSI collaborates with Linda Lilienfeld, an independent film researcher, on **Let's Talk About Water (LTAW)**, a unique film symposium that combines the power and inspiration of film with the knowledge of an expert panel. During LTAW events, the audience along with the panelists view a water documentary (such as "Flow," "Gasland," or a "Civil Action"), followed by a moderated discussion between the audience and the panelists in an effort to address complex water issues facing society and the local community.

This year, CUAHSI supported two LTAW events that took the LTAW formula, originally designed for an undergraduate audience to spur interest in water science, to new venues and audiences: Rick Hooper participated in a week-long LTAW event at the 6th World Water Forum in Marseilles, France and in an event for scientists at the NASA Goddard Space Flight Center. To date, CUAHSI has

Let's Talk About Water Events help to engage audiences in conversations around complex water issues, engenders critical thinking skills amongst participants, and provides teachable moments through film.



helped to organize over 10 LTAW events and continues to expand its program with a planned 2013 science communication LTAW workshop to take place at Boston's Museum of Science.

LTAW Challenge Grants

In the fall of 2012, CUAHSI piloted a grant program aimed to help financially support universities in hosting a Let's Talk About Water event. Through private donor funds and a Johnson Family Foundation grant, CUAHSI will award six Challenge Grants, of up to \$3000 each, to selected universities for use in 2013. These grants were established on a \$1-to-\$1 matching basis and include the services of LTAW Program Director, Linda Lilienfeld, to assist with developing the programs. Ten grants were submitted to CUAHSI for review from universities across the United States and with diverse program objectives. CUAHSI will continue to seek additional support so that we can provide our university community with this *unique and fun* educational resource.

Cyberseminars

Cyberseminars are web-based research seminars that draw from the broad expertise of the water science community and allow students and researchers to participate in live sessions or view recorded sessions from their desktop, laptop or mobile device. Since the fall of 2003, CUAHSI has had fall and spring cyberseminar series, as well as special webinars. CUAHSI works with a series host, drawn from a member university. Hosting provides an opportunity, particularly for younger faculty, to design the series and topic around their own interests and make connections in the larger community. The fall 2012 series, *Exploring Cutting Edge Techniques and Advances in Instrumentation*, was organized by Adam Ward (University of Iowa), featured five diverse speakers, and marked our **100th Cyberseminar** on October 19th. John Selker's seminar on November 9th had our largest live audience for any cyberseminar, with over 70 connections. Recordings of cyberseminars are archived on CUAHSI's cyberseminar webpage (<http://www.cuahsi.org/sem-archive.html>) and are uploaded to SciVee, The WaterChannel and YouTube for dissemination to the broader community.

Pathfinder Fellowship Program

CUAHSI's Pathfinder Graduate Student Fellowship Program funds travel for graduate students to make an extended field site visit that enhances their research program by broadening the traditional "one site, one view" approach common in hydrology. Fellows have traveled to an additional field site (or research laboratory) to conduct comparative research, to collaborate with a research group using alternate approaches or modeling methods, or to work with researchers on adding an interdisciplinary dimension to a water science research project.



2011 Pathfinder Fellow (Tracie Jackson)

CUAHSI provides travel grants of up to \$5000 per fellow. Five Pathfinder Fellows were awarded in 2011. Many of the awardees have completed their research and have reported that without the travel assistance from CUAHSI, the experience would not have been possible.

2011 Pathfinder Fellows

Research

Ryan Gordon

Syracuse University, Department of Earth Sciences

Travelled to Lima, Peru in summer 2012 to study groundwater-stream water interactions of alpine glacial stream systems to contribute to the science on water quality and quantity problems in a developing agricultural society.

Tracie Jackson

Oregon State University, Department of Geosciences

Travelled to the University of Idaho, Boise during the summer 2012 to conduct open channel flow laboratory experiments using the large-scale flume located at the Center for Echohydraulics Research (CER) Mountain StreamLab.

Keshia Koehn

University of Notre Dame, Department of Civil Engineering and Geological Science

Will be traveling to the University of Vienna for a month between November and December 2012 to collaborate with researchers in the field, to collect data, and to gain access to laboratory equipment at the University for data analysis.

Katrina Koski Henry
New Mexico Tech, Department of Earth and
Environmental Science

Kenneth Takagi
Boston University, Department of Earth Sciences

Will be traveling to Florida to conduct field work as an added dimension to her research modeling karst systems. Henry will also travel to Reno, NV to work with a group at GeoHydros to discuss alternative modeling techniques to be incorporated into research.

Travelled to the Luquillo Critical Zone Observatory (CZO) during summer 2012 to collect stream, soil, and vegetation samples for comparison to data collected at Hubbard Brook Environmental Forest. Research aims to develop a Ca budget for terrestrial ecosystems.

CUAHSI received a record number 23 Pathfinder Fellowship applications during the 2012 application process. This year's awardees will be announced in conjunction with the **CUAHSI Annual Town Hall Meeting (Tuesday, December 4, 2012)** at the Fall American Geophysical Union (AGU) Meeting.

In addition to the Pathfinder program, CUAHSI has information on our website on **Graduate Water Science Programs** and other resources for students. CUAHSI works to increase diversity in water science by organizing sessions and workshops at various 2012 conferences, including the Society for Advancement of Chicanos and Native Americans in Science (SACNAS) and at the Geoscience Alliance.

V. COMMUNITY ACTIVITIES

2012 Biennial Meeting

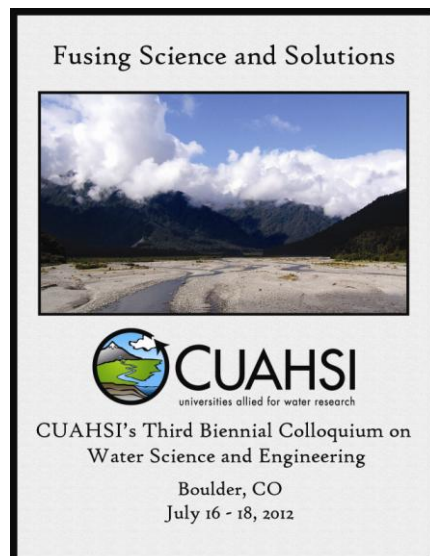
CUAHSI's Colloquium on Water Science and Engineering is a biennial opportunity for the water science community to come together around a high quality science program. The planning committee places value on personal interactions with colleagues in a smaller, more intimate setting. This year, we held our **3rd Biennial Meeting, around a theme of "Fusing Science and Solutions"** on July 16-18th, 2012 on the campus of UCAR (University Corporation for Atmospheric Research) in Boulder, Colorado. This 2012 event was once again a unique and quality meeting for water science researchers and professionals, and saw increased participation from both 2008 and 2010. The meeting included three invited keynote lecturers, 28 invited session speakers, eight session moderators, six organized workshops, and a poster sessions featuring over 70 posters from professionals and students.

CUAHSI presented our **Biennial Community Service Awards** during the Meeting banquet, to **Dr. Vijay K. Gupta** for his leadership in the development of interdisciplinary research in hydrologic science, and **Linda Lilienfeld**, for her contributions to communicating science to the public through film.

A new addition to this year's program was the free showing of the water documentary, "Last Call at the Oasis," which took place after the banquet dinner. The venue was filled to capacity, with close to 100 people in attendance. The showing was accompanied by a short discussion with the film's director, Jessica Yu, and James Famiglietti, CUAHSI member and expert scientist showcased in the film. Feedback from post-event surveys confirmed that the film showing was a beneficial addition to the meeting. We will consider more events like this for future meetings.

CUAHSI 3rd Biennial Meeting Highlights

- **164** total registered attendees at the 2012 Biennial meeting.
- **51** student attendees at the 2012 Biennial meeting.
- **444** views of Biennial Plenary presentations on the CUAHSI YouTube Channel.
- **84%** of respondents to a post-meeting survey rated the scientific content a 4 or 5 (on a five point scale with 5 being best).
- **90%** of respondents to a post-meeting survey plan on attending the next Biennial meeting



EarthCube Activities

The National Science Foundation's (NSF) EarthCube initiative seeks transformative concepts and approaches to create integrated data management infrastructures across the Geosciences. The EarthCube initiative provides an opportunity for the water science community to build on the success of the HIS project and to advocate for many of the technological and infrastructure needs the water modeling community identified by the series of workshops CUAHSI held around Community Hydrologic Modeling in 2009-2011 through the "CHyMP" initiative.

CUAHSI is actively engaged in activities on multiple EarthCube awards, including an **EAGER Earth Systems Modeling Concept Award** (led by David Gochis at NCAR, and with Jennifer Arrigo as a Co-PI), which strives to explore coupling mechanisms between components of hydrologic and atmospheric models, and advances CHyMP goals of evaluating different modeling frameworks for the hydrologic community's use. Rick Hooper is also a Co-PI on the **EAGER OHMF Concept Award, From Data to Users: A Prototype Open Modeling Framework**, led by Xu Liang of University of Pittsburgh, which is exploring community platforms and frameworks that can enable community modeling.

One of the most pressing needs identified by the CHyMP workshops was the availability of better subsurface information. CUAHSI has been awarded a workshop grant through EarthCube (**EarthCube End User Workshop Award: Envisioning a Digital Crust for Earth System Science**) to hold an end user workshop to develop functionality statements and use cases for a national spatial data infrastructure for three dimensional subsurface information. This workshop will be held in January 2013.

EarthCube is an important opportunity for water science and geoscientists in general. The potential of cyberinfrastructure to transform the way we do research is high, but will only be realized if the geosciences community is engaged and contributes to the development of functional requirements and expectations of EarthCube. As a community organization, CUAHSI is working to follow EarthCube developments and disseminate opportunities and information to our scientists.

Communications

With growing membership, programs, services, and the establishment of new collaborations within the water science community, CUAHSI is streamlining its online image. Over the past several months, **the CUAHSI website has been under re-development and redesign. The unveiling of a new CUAHSI website will occur December 2012.** Staff and the Board of Directors have been working together tirelessly to provide you with a better online resource.

CUAHSI also distributes a monthly electronic newsletter, the CUAHSI [eNews Brief](#). The online newsletter acts as a voice for the community by highlighting activities, announcing research opportunities, and reporting on upcoming and past events. The electronic newsletter is distributed through CUAHSI's listservs, which reach close to 900 people. CUAHSI encourages the community to submit photos from field research to CUAHSI that will be documented in a future online photo gallery.

CUAHSI is also active on social media! Follow the Consortium online through Facebook, Twitter, LinkedIn, our YouTube channel, and the new HIS blog.

CUAHSI also continues to work to raise awareness of CUAHSI services and opportunities to the broad community of water researchers. CUAHSI exhibits and/or participates at several professional society conferences and meetings each year, providing an opportunity for community members from various disciplines to meet with CUAHSI staff and Directors, learn more about CUAHSI services and explore opportunities to get involved with the Consortium.



Partnerships and Collaborations

One role of CUAHSI as a community organization is to represent the interests of the water science research community and to expand opportunities for interdisciplinary and international collaborations for water science research and education. CUAHSI's presence and participation in national and international research and education initiatives seeks to expand opportunities for our members and ensure that water science research and community needs are well represented.

Rick Hooper assisted Linda Lilienfeld (LTAW Director) in establishing a presence at the **6th World Water Forum (WWF) held March, 2012 in Marseilles, France**, by holding an off-site four-day Let's Talk About Water event. The program showcased multiple films daily and each was followed by a discussion by an international panel. The event was not typical of LTAW events with which CUAHSI normally assists, as it was an international event with a decidedly different target audience of international meeting attendees. However, it did provide an opportunity to raise the visibility of the program.

UN Commission on Hydrology of the World Meteorological Organization

CUAHSI has been recognized as an international organization by the Commission on Hydrology and, thus, has an observer status to attend the meetings of this organization. The CHY consists

of the world's hydrologic services (such as the USGS or the Water Survey of Canada) and meets every four years to lay out a program of cooperation among the participating nations. Rick Hooper was invited to the recent quadrennial meeting in Geneva to make a presentation on WaterML2, the data transmission language used by CUAHSI HIS. At the conclusion of this meeting, the CHY approved a process for considering WaterML2 as a global standard and encourages the world's hydrologic services to test the use of WaterML2. This recognition is a validation of the importance of the work done by the CUAHSI HIS project and promises to bring global data sharing to a new level.

US Water Partnership

Announced in March 2012 by U.S. Secretary of State Hillary Rodham Clinton, the U.S. Water Partnership (USWP) unites and mobilizes U.S. expertise, resources and ingenuity to address water challenges around the globe, particularly in the developing world. A joint effort of both public and private sectors in the U.S., the partnership is supported by government agencies, academic organizations, water coalitions, NGOs and the private sector. CUAHSI is working with the USWP to bring the tools and services of CUAHSI HIS to this effort.

CUAHSI has received a challenge grant of \$50,000 for the development of a customized data portal, based on CUAHSI HIS technology, from Asa Johnson. We are working with USWP to identify a matching donor to secure these funds which will be used to develop this portal.

VI. RESEARCH SUPPORT AND COLLABORATIONS

CUAHSI's core mission is to provide research support services for the water science community. We encourage researchers to include CUAHSI services, such as CUAHSI HIS data access and publication services, and our education and outreach tools, in your proposal. These services are available to all NSF-funded researchers.

In addition to our standard services, CUAHSI often works with our university colleagues on research projects for community benefit. For example, in 2012, CUAHSI provided 15 letters of support to proposed research projects, which would use and expand the capabilities of the HIS system. In these cases, CUAHSI is a research collaborator that works with the PI to adapt or develop new technology or services over the course of the project.

2012 Meetings & Conference Presence

AAG Conference
Geoscience Alliance
AWRA Spring Specialty Conference on GIS and Water Resources
Shale Network Annual Workshop
USU Spring Runoff Workshop
6th World Water Forum
Tufts University WSSS Symposium
CNSF Capitol Hill Reception
ASCE-EWRI Conference
3rd Biennial CUAHSI Symposium
Fifty Years of Watershed Modeling
Aberdeen Catchment Science
Summer School
EarthCube Charrette & Workshops
IWRSS Scoping Workshop
GSA Annual Meeting
AGU Fall Meeting
2012 Workshops & Events
Hydroacoustics Workshop
SW-GW Hands-on Workshop
LTAW Program – Marseilles, France
LTAW Program – NASA Goddard

CUAHSI also partners with our university colleagues on research projects which have the potential for wide community benefit. CUAHSI staff may participate as Co-PIs on proposals which align with CUAHSI's strategic objectives and which involve research that could be adapted to or inform the development of community services.

Funded Projects

Geoinformatics: Development of Community-Based Ontology and Standards for Hydrologic Data Discovery and Exchange

NSF Award # 0949196

PI: Richard Hooper (CUAHSI)

Co-PIs: Ilya Zaslavsky (SDSC)

Michael Piasecki (CCNY)

David Valentine (SDSC)

CUAHSI has been involved in the development of Water Data Services (WDS) through the CUAHSI Hydrologic Information Systems (HIS) project. The vision for WDS is to bring together the nation's (and, potentially, the earth's) water data in a federated system of servers linked using a services-oriented architecture. CUAHSI WDS is used by both academic researchers and by government data providers at both the Federal and State levels.

A critical challenge in achieving this vision is understanding and reconciling structural and semantic differences across publishers of hydrologic data. The HIS project achieved interoperability between different data repositories by developing a common relational schema (Observations Data Model, ODM V1.1), an XML schema for exchanging hydrologic observations (Water Markup Language, WaterML V1.0), and a prototype ontology (V1.0) of hydrologic concepts that is used for data discovery purposes. Experience has shown that the prototypes for WaterML and the ontology are in need of further development. This project will address the underlying semantic problem through the development of a more comprehensive, extensible ontology that harmonizes the more generic information model contained within ODM with those from various existing federal information sources. This includes the development of a community process for an evolving hydrologic ontology.

RCN-SEES: The Marcellus Shale Research Network

NSF Award # 1140159

PI: Susan Brantley (Principal Investigator)(Penn State)

Co-PIs: Richard Hooper (CUAHSI)

Candie Wilderman (Dickenson)

Kathryn Jo Brasier (Penn State)

Jorge Abad (University of Pittsburgh)

This project is to develop a sustainable RCN to organize and generate knowledge from water chemistry and flow data collected in Pennsylvania in the area of extraction of natural gas from the Marcellus shale. We will focus on the research hypothesis: Sustainable development of the Marcellus Shale will be enabled by creation of a database of geochemistry and hydrology developed by watershed groups, government agencies, industry stakeholders, and universities working together to document natural variability and potential environmental impacts. The proposal focuses on Pennsylvania, the site of the largest new shale gas play in the United States. The network will be led by two research universities, Penn State and Pitt, and a private liberal arts college, Dickinson, in collaboration with the Consortium of Universities for the Advancement of Hydrologic Sciences, Inc. (CUAHSI).

EAGER: Collaborative Research: Developing a Community Computational Infrastructure for Earth System Model Research and Applications

NSF Award #1239703

PI: Jennifer Arrigo (CUAHSI)

This collaborative proposal is being led by Dave Gochis (NCAR), and also involves collaborative projects at CSDMS (PI: Scott Peckham) and University of California at Irvine (PI: Jay Famiglietti)

This EAGER award focuses on exploring the feasibility of the implementation of a new paradigm in the development of an integrative and interoperable data and knowledge management system for the geosciences for a new NSF initiative called EarthCube. Led by a team of expert Earth system modelers, this project focuses on developing new approaches for integrating and coupling model components so that holistic geoscience scenarios that involve the interaction of large scale climate and atmospheric circulation models and smaller, more heterogeneous component models of surface earth processes can be explored and more effectively used by a broader range of users. The project engages participants from a number of major NSF-funded geoscience modeling investments (CSDMS, NCAR, and CUAHSI). A main goal of the work is to bridge the gaps between present modeling frameworks, data standards, and computational architectures.

COLLABORATIVE RESEARCH: From Data to Users: A Prototype Open Modeling Framework

NSF Award#1245076

PI: Richard Hooper (CUAHSI)

This grant is part of a collaborative research project under EarthCube EAGER grant concept awards, being led by Xu Liang (University of Pittsburgh).

This EAGER award allows the construction of a prototype open meta-modeling framework that significantly reduces the time and effort on the part of users in the preparatory work for data and model comparisons, model testing and validations, for making fundamental knowledge discoveries in surface and ground water hydrological systems. In this framework, components/modules interact via user-configured open interfaces that allow the addition and integration of hydrological models and data sources using a common meta-level architecture and scientific workflows. The proposed prototype is based on a recently completed modeling framework, HS-NWSRFS (Hydro-information System for improving the National Weather Service River Forecast System). It represents a collaboration between investigators from three institutions, NASA, and NWS Ohio River Forecast Center (OHRFC). The funded effort will significantly expand the present code into an open community framework prototype.

EarthCube GEO Domain Workshop Proposal: Envisioning a Digital Crust for Simulating Continental- Scale Subsurface Fluid Flow in Earth System Models

NSF Award # 1251557

PI: **Jennifer Arrigo (CUAHSI)**

Co-PIs: *Ying Fan Reinfelder (Rutgers University), Norman Jones (Brigham Young University)*

In order to advance the understanding of the critical zone and deeper crust and to better couple the exchange of mass and energy between the surface and the subsurface, this project will hold 3-day workshop to develop a long-term vision of a digital representation of the continental crust of N. America and design concepts for prototype data model(s). The digital catalog of crustal structure, composition and permeability (as well as parameters from which permeability could be inferred) define the mechanisms by which to integrate vast amounts of disparate data types and to construct a coherent, 3D picture of subsurface structure and material properties, so that we can begin to represent subsurface fluid flow in Earth system models and elucidate its critical controls in the evolution of the Earth system from the past to the present and the future.

Collaborative Research: SI2-SSI: An Interactive Software Infrastructure for Sustaining Collaborative Community Innovation in the Hydrologic Sciences

NSF Award #1148453

PI: *David Tarboton (Principal Investigator) (Utah State University)*

Co-PIs: *David Maidment (Co-Principal Investigator) (UT- Austin)*

Daniel Ames (Co-Principal Investigator) (Brigham Young University)

Jonathan Goodall (Co-Principal Investigator) (University of South Carolina)

Jennifer Arrigo (Co-Principal Investigator)(CUAHSI)

This project develops sustainable cyberinfrastructure for better access to water-related data and models in the hydrologic sciences, enabling hydrologists and other associated communities to collaborate and combine data and models from multiple sources. It will provide new ways in which hydrologic knowledge is created and applied to better understand water availability, quality, and dynamics. It will also help to provide a more comprehensive understanding of the interactions between natural and engineered aspects of the water cycle. These goals will be achieved through the development of interoperable cyberinfrastructure tools and the creation of an online collaborative environment, called HydroShare, which enables scientists to easily discover and access hydrologic and related data and models, retrieve them to their desktop, and perform analyses in a high performance computing environment. The software to be developed will take advantage of existing NSF cyberinfrastructure (iRODS, HUBzero, CSDMS, CUAHSI HIS) and be created as open source code. Its development will be end user-driven.

CUAHSI is providing community oversight through our Informatics Standing Committee, User Support and engagement through the HIS User committee, community engagement and dissemination through CUAHSI Hydroinformatics conferences and communication mechanisms, and supporting development of education and outreach materials related to HydroShare.

Collaborative Research: Standards-Based Cyberinfrastructure for Hydrometeorological Modeling: US-European Research Partnership

NSF Award# 1234680

PI: **Richard Hooper (Principal Investigator) (CUAHSI)**

Co-PI: *Ilya Zaslavsky (SDSC)*

This project is a Collaborative Research project. The partner NSF-funded project is being led by Dave Gochis (NCAR) and also involves Rutgers University. Additionally, this project is a collaboration with the EU-funded DHRIM project.

This project, Standards-based CyberInfrastructure for HydroMeteorology (SCIHM), seeks to link two disciplines--hydrology and meteorology--each of which has a sophisticated CI already developed within their respective disciplines. This linkage will be accomplished with hydrometeorology use cases in Europe and America that will be executed in both the European and American grid computing environments using federated data and computing standards. With research and development partners from several American and European institutions, the project is designed to take advantage of standards-based CI for hydrometeorological applications. In doing so, we will foster a unified standards-based hydrometeorological infrastructure where researchers and students from Europe and the US can rapidly simulate complex physical processes and predict extreme weather events and their hydrological, environmental and societal impacts, taking advantage of scalable on demand high-performance cloud-based computational resources and shared data space. Computational and storage layers will be seamlessly integrated with standards-based domain data services, analysis tools and models, enabling researchers and practitioners to quickly tune predictive models to their areas of interest, discover and access distributed sources of information, and engage in a collaborative analysis and interpretation of prediction results. This project will engage the broader hydrologic and meteorologic research community through CUAHSI and UCAR, the respective university consortia for these disciplines, as well as European partners.

Developing Community Services

Standing Committees are composed of members from across the broad community of water sciences and are established to provide counsel, advice, and direction on specific programmatic topics. CUAHSI has six standing committees: Education & Outreach, Informatics, Instrumentation, Observations, Research Applications, and Synthesis. In addition, CUAHSI has a HIS User Committee that focuses on the development of the HIS system, an audit committee, and a senior advisory council.

OBSERVATIONS STANDING committee

Dave CHANDLER (Chair)	Syracuse University
Jim McNAMARA (Board Liaison)	Boise State University
William BALL	Johns Hopkins University
Paul BROOKS	University of Arizona
Wendy GRAHAM	University of Florida
Miki HONDZO	University of Minnesota
Jan HOPMANS	University of California, Davis
Henry LIN	Penn State University
Franco MONTALTO	Drexel University

RESEARCH APPLICATIONS STANDING committee

Allen BRADLEY (Chair)	University of Iowa
Todd RASMUSSEN (Board Liaison)	University of Georgia
Laura BOWLING	Purdue University
Kristie FRAZN	Iowa State University
Stu SCHWARTZ	University of Maryland, Baltimore County
Rich VOGELI	Tufts University
Ralph WURBS	Texas A&M University

SYNTHESIS STANDING committee

(Chair - *Vacant)

Aaron PACKMAN (Board Liaison)	Northwestern University
Kevin BISHOP	Swedish University of Agricultural Sciences
Beth BOYER	Penn State University
Charles VOROSMARTY	CUNY

VII. FINANCIAL OVERVIEW

The Consortium of Universities for the Advancement of Hydrologic Science, Incorporated (CUAHSI), is a 501(c)(3) nonprofit consortium of universities established in 2001 to focus on common needs of scientific hydrology and address common infrastructure needs and the overall research and education agenda. CUAHSI is incorporated in the District of Columbia. A complete copy of CUAHSI's financial statements and auditor's reports are available from CUAHSI by contacting busmgr@cuahsi.org.

2012 CUAHSI Budget

Core Program Budgets*

Program	FY2012 Budget
HIS	\$ 606,461
CUAHSI Biennial	\$ 113,646
Community Outreach	\$ 189,400
Instrumentation	\$ 93,311
Education and Outreach	\$ 68,208
Community Modeling Activities	\$ 56,938
Management Review	\$ 43,203
Indirect Costs	\$ 489,429
Total Core Program Budget	\$ 1,660,597

*Core Program Budgets are those funded by the Cooperative Agreement from NSF Earth Sciences Division Hydrologic Sciences Program.

Additional Funding

In 2012, CUAHSI also received a \$20,000 grant from the Johnson Family Foundation to support Let's Talk About Water Challenge Grants, and a \$70,000 gift from a donor to support the World Water Forum Let's Talk About Water event and the LTAW Challenge Grants.

Overview of Program Budgets

CUAHSI HIS

Funding for CUAHSI HIS is used to fund our User Support Specialist, and staff management of the HIS project, staff travel to participate in meetings and hold trainings, publication of HIS advertising and training materials, and software and hardware maintained at the CUAHSI office. This budget also includes professional services contracts and subawards to Sand Diego Supercomputing Center, Utah State University, and Brigham Young University for support, maintenance and development of the CUAHSI HIS components during this transition year. Funding is also used for staff support of the Informatics Standing Committee.

CUAHSI Biennial

Funding for the CUAHSI Biennial was used to pay publication, printing, facilities, and catering costs associated with the meeting, support staff time in executing the Biennial, support the travel of invited speakers and session organizers, and provide student travel grants.

Community Outreach

The Community Outreach budget funds community activities such as CUAHSI's exhibitions and events at professional meetings such as the AGU and GSA annual meetings, CUAHSI's website and newsletter, and costs associated with the CUAHSI Board of Directors.

Instrumentation

Funding for Instrumentation is used for staff support of the Virtual HMF and the Instrumentation Standing Committee, execution of Hands-On Workshops, and includes a subaward to the University of Arizona for the HydroGeoPhysics travel grant program.

Education and Outreach

Funding for the Education and Outreach programs supports the Pathfinder Graduate Student fellowships, the production of the Cyberseminar series and archives, and staff participation in the Let's Talk About Water program. Funding is also used for staff support of the Education and Outreach Standing Committee.

Community Modeling

Funding for community modeling is used for staff support in monitoring and participating in relevant community modeling activities, including staff and community participation in EarthCube initiatives. Funding for this activity is also used to provide travel support to community members to facilitate community involvement in EarthCube and in the joint NWS/USGS/US-COE *Integrated Water Resources Sciences and Services (IWRSS)* National Water Model initiative.

Management Review

The Management Review budget is used to fund staff time supporting activities that ensure a well-functioning Consortium. These include participating in a required management review by NSF in February 2012, aspects of governance (supporting activities of the Board of Directors) coordination and communication with NSF, managing mechanisms for community input, and supported unfunded Standing Committees (Research Applications, Observational Strategies, and Synthesis).

Indirect Costs

Costs include corporate administration and business staff salaries; audit, human resources and legal services; office expenses at the CUAHSI Administrative office (Washington, DC) and the Program Office (Medford, MA); and insurance.

CUAHSI Board of Directors and Officers

Term expires 12/31/2012

Robyn Hannigan, University of Massachusetts-Boston

Carol Johnston, South Dakota State University

Witold Krajewski, University of Iowa

Larry Murdoch, Clemson University

Aaron Packman, Northwestern University

Term expires 12/31/2013

David Freyberg, Stanford University

Brian McGlynn, Duke University

Jim McNamara, Boise State University

Todd Rasmussen, University of Georgia

Ying Fan Reinfelder, Rutgers University

Term expires 12/31/2014

Diogo Bolster, University of Notre Dame

Peter Troch, University of Arizona

Scott Tyler, University of Nevada-Reno

Denice Wardrop, Pennsylvania State University

David White, Murray State University

Current Officers

President: Rick Hooper

Secretary: Adam Ward

Treasurer: Rina Schumer

Chair: Witold Krajewski

Past Chair: Larry Murdoch

Chair-Elect: Robyn Hannigan

The CUAHSI Mission is to:

Support the community to advance water science and to improve societal well-being by...

- developing, supporting, and operating research infrastructure;
- improving access to data, information and models;
- articulating priorities for community level water-related research and observations;
- facilitating interactions among the diverse water research community;
- promoting interdisciplinary education centered in water science; and
- translating scientific advancements into effective tools for water management and policy.

CUAHSI Staff

Richard Hooper, President and Executive Director
Jennifer Arrigo, Program Manager
Kayla Berry, Communications & Outreach Specialist
Jonathan Pollak, User Support Specialist

Jessica Annadale, Controller
Lisa Gray, Accounting Assistant

